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Original research

The comparison of clinical results between hand suturing and mechanical stapling for gastrojejunostomy and jejunojejunostomy after SSPPD

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ABSTRACT

Background: Mechanical stapling method is widely established alternative to conventional hand suturing.
Method: For gastrointestinal anastomoses. In this study, we compare the clinical results of mechanical stapling with those of hand suturing for gastrojejunostomy and jejunojejunostomy after Subtotal Stomach Preserving Pancreaticojejunostomy (SSPPD).
Methods: Between 2002 and 2007, 42 patients who underwent SSPPD with concise records on operative procedure and time required for gastrojejunostomy and jejunojejunostomy were enrolled. Out of 42 patients, the mechanical stapling for gastrojejunostomy and jejunojejunostomy after SSPPD was performed for 19 patients and hand suturing for those in SSPPD was done for 23 patients.
Results: All clinical characteristics were similar in both groups. There was no statistical difference between both groups in the rate of complications related to gastrojejunostomy and jejunojejunostomy. However, days of nasogastric intubation and days until liquid diet in the stapled group were significantly shorter than those in the hand sutured group. Time required for gastrojejunostomy and jejunojejunostomy was significantly shorter in the stapled group than in the hand sutured group.
Conclusions: This study suggested that stapled anastomoses might require a shorter time to perform and decreased time for nasogastric intubation and until liquid diet is introduced.

1. Introduction

Pancreaticoduodenectomy is one of the most invasive surgeries for patients. It is also one of the most laborious for a digestive surgeon. It is difficult to perform radical pancreaticoduodenectomy with safety. Moreover, since reconstruction of biliary and pancreatic pathways is a very complicated procedure, it places an enormous demand of will power and physical strength on digestive surgeons. Therefore, it is desirable to establish safe and reliable reconstruction method of gastrointestinal anastomoses that alleviate time and labor.

Recently, the use of automatic stapler for gastrointestinal anastomoses is widely accepted. The mechanical stapling method is thought to shorten operating time as well as facilitate the anastomotic procedure. In this article, we compare mechanical stapling to hand suturing in gastrojejunostomy and jejunojejunostomy after Subtotal Stomach Preserving Pancreaticojejunostomy (SSPPD).

2. Patients and methods

Patients who underwent SSPPD from April 2002 through December 2007 with available records on operative procedure and time required for gastrojejunostomy and jejunojejunostomy were eligible for this study. A total of 42 patients who received SSPPD were enrolled. There were 22 females and 20 males with a median age of 65.7 years (65.7 ± 9.9, range 33–83). 19 patients received mechanical stapling and 23 were treated by hand suturing for gastrojejunostomy and jejunojejunostomy after SSPPD. The diseases of the stapled and hand sutured groups are shown in Table 1. The time required and complications of gastrojejunostomy and jejunojejunostomy, days of nasogastric intubation, days until liquid diet, and delayed gastric emptying were compared between both groups. Clinical characteristics (age, gender, benign or malignant condition, presence of diabetes mellitus, preoperative Albumin value) were analyzed in both groups. All the procedures were performed by one surgeon using the same technique, same approach to avoid technical bias.

3. Statistical analysis

Continuous variables were reported as the mean ± standard deviation and compared using the Mann–Whitney *U* test. Categorical variables were compared using the Fisher test. A two-sided p value<0.05 was considered statistically significant.

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Table 1
Disease of the patients who underwent SSPPD in the hand-sutured group and stapled group.

Disease	Hand-suturing ($n = 23$)	Stapling ($n = 19$)
Carcinoma of the pancreas head	12	7
Carcinoma of the vater papilla	1	1
Carcinoma of the lower bile duct	3	4
Carcinoma of the duodenum	1	1
Carcinoma of the gall bladder	2	1
Intraductal papillary mucinous adenocarcinoma of the pancreas head	1	1
Intraductal papillary mucinous adenoma of the pancreas head	0	2
Tumor forming pancreatitis	1	1
Islet cell tumor of the pancreas head	1	0
Duodenal GIST	1	0
Carcinoma of the transverse colon	0	1

4. Surgical procedure

SSPPD involved division of the stomach 2–3 cm proximal to the pylorus ring with resection of all of the duodenum distal to the transection site, resection of the gall bladder and common bile duct, and removal of the pancreas head. After SSPPD, duct-to-mucosa pancreaticojejunostomy with end-to-side technique, an end-to-side choledochojejunostomy were conducted. Further downstream, side-to-side antecolic gastrojejunostomy and side-to-side jejunojejunostomy with mechanical stapling, or end to side antecolic gastrojejunostomy and side to side jejunojejunostomy with hand suturing were performed. For mechanical stapling, the linear stapler (United States Surgical, Norwalk, CT, USA) was inserted through the gastrotomy on the greater curvature of the gastric closure and the jejunotomy. Then side-to-side gastrojejunostomy was performed. Side-to-side jejunojejunostomy(20 cm from gastrojejunostomy) were conducted in a same manner (Fig. 1). Hand suturing was done using Albert-Lembert anastomoses. Albert anastomoses were performed with 3–0 Polysorb (United States Surgical, Norwalk, CT, USA) continuous sutures. Lembert anastomoses were performed with 3–0 silk interrupted sutures.

5. Results

In comparison of clinical characteristics (age, gender, benign or malignant condition, presence of diabetes mellitus, pre-operative Albumin value), no difference was observed statistically between the stapled group and the hand sutured group (Table 2). In the stapled group, complication of gastrojejunostomy and jejunojejunostomy occurred in 1 (gastric ulcer) of 19 patients (5.3%). In the hand sutured group, a wound infection occurred in 1 of 23 patients (4.3%) and a pneumothorax occurred in 1 of 23 patients (4.3%). There was no statistical difference between both groups in the rate of complications related to gastrojejunostomy and jejunojejunostomy. Days of nasogastric intubation in the stapled group (4.2 ± 1.5 days) were significantly shorter than that in the hand sutured group (5.8 ± 1.4 days) ($P < 0.0001$). And days until liquid diet in the stapled group (8.4 ± 2.1 days) were significantly shorter than that in the hand sutured group (9.9 ± 1.9 days) ($P = 0.02$). Time required for gastrojejunostomy and jejunojejunostomy was significantly shorter in the stapled group (16.4 ± 2.0 min) than in the hand sutured group (35.2 ± 5.3 min)($P < 0.0001$)(Table 3).

6. Discussion

The mechanical stapling method has been applied for gastrointestinal anastomosis for these 30 years. In 1980s, mechanical stapling method was compared with hand suturing method for esophagojejunostomy after total gastrectomy.[1–8] The rate of anastomotic leakage was reported from 5.0% to 14.3% for mechanical stapling as compared with 0%–29% for hand suturing in these studies. Nowadays, improved devices and accumulated experiences with such devices have further led to a decline of anastomotic leakage. In previous reports concerning Billroth II anastomosis after distal gastrectomy for reconstruction, mechanical stapling have been compared with hand suturing. Weiz and Scherz described that 12 in 474 patients with hand sutured anastomosis had bleeding, stenosis and anastomotic leakage. Whereas, none of 71 patients with mechanical stapled anastomosis had these complications. In their conclusions, mechanical stapling anastomosis was superior to hand suturing anastomosis. In this study, we compared the mechanical stapling with hand suturing for gastrojejunostomy and jeunojejunostomy after SSPPD. Regarding jejunojejunostomy in SSPPD, a usefulness of jejunojejunostomy (Braun anastomosis) in the reconstruction after pancreaticoduodenectomy is not evaluated. We perform Braun anastomosis to prevent back current of bile and pancreatic juice to remnant stomach. To evaluate the usefulness of the Braun anastomosis in the reconstruction after

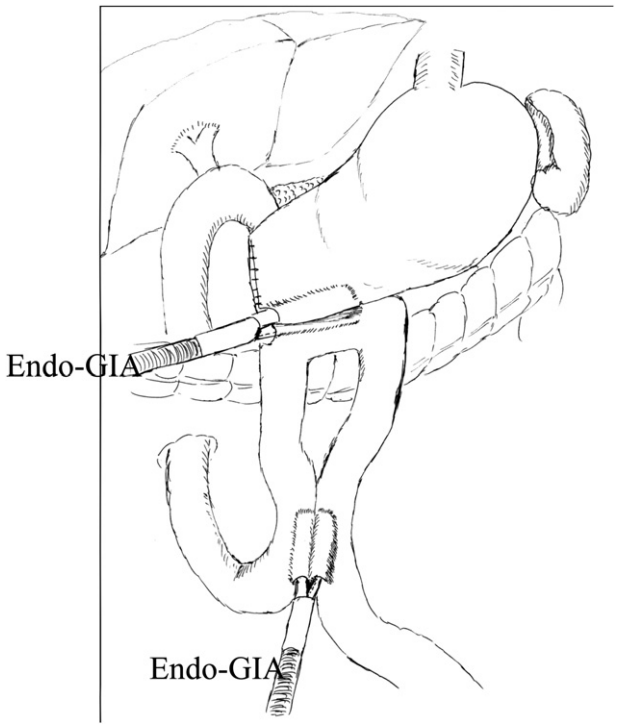

Fig. 1. The linear stapler was inserted through the gastrotomy on the greater curvature of the gastric closure and the jejunotomy. Then side-to-side gastrojejunostomy was performed. Side-to-side jejunojejunostomy (20 cm from gastrojejunostomy) were performed in a same manner.

Table 2
Comparison of demographics and clinical characteristics in the hand-sutured group and stapled group.

	Hand-suturing ($n = 23$)	Stapling ($n = 19$)	*P*-Value
Age (yr)	64.3 ± 9.1	67.4 ± 10.9	0.3
Gender (M/F)	10/13	12/7	0.2
Benign/malignant	1/22	3/12	0.1
DM (yes/no)	5/18	9/10	0.07
Preoperative serum albumin value (g/dl)	3.7 ± 0.5	3.6 ± 0.6	0.4

Table 3
Post-operative course in the hand-sutured group and stapled group.

	Hand-suturing ($n = 23$)	Stapling ($n = 19$)	*P*-Value
Time required for anastomosis (min)	35.2 ± 5.3	16.4 ± 2.0	$p < 0.001$
Post-operative complication (yes/no) (Pneumothorax, wound infection) (gastric ulcer)	2/23	1/19	0.6
Days of nasogastric intubation	5.8 ± 1.4	4.2 ± 1.5	$p < 0.001$
Days until liquid diet	9.9 ± 1.9	8.4 ± 2.1	0.02
Delayed gastric emptying (yes/no)	3/23	3/19	0.8

pancreaticoduodenectomy, a prospective randomized controlled trial is conducted to compare the incidence of complications with or without Braun anastomosis at Department of surgery, Nagasaki University hospital in Japan. We look forward to results of the study. In comparison of clinical characteristics, no difference was observed statistically between the stapled group and the hand sutured group. Regarding the rate of complication related to gastrojejunostomy and jejunojejunostomy, there was no statistical difference between both groups. However, days of nasogastric intubation and days until liquid diet in the stapled group were significantly shorter than those in the hand sutured group. Moreover, time required for gastrojejunostomy and jejunojejunostomy was significantly shorter in the stapled group than in the hand sutured group. In conclusions, there is high possibility that mechanical stapling might require a shorter time to perform gastrojejunostomy and jejunojejunostomy after SSPPD and decreased time of nasogastric intubation and until liquid diet is introduced, as compared to hand suturing in SSPPD. The mechanically stapling for gastrojejunostomy and jejunojejunostomy after SSPPD might place less stress on the pancreatic surgeons.

Ethical approval
None.

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Author contribution
None.

Conflict of interest
None.

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